

Commentary Commentaire

Eco-Health: A primer for veterinarians

David Waltner-Toews

Since the 1950s, veterinary work has expanded from a concern with the health and diseases of individual animals, to groups of animals (herd and flock health), people (public health), business economics (which grew out of herd health), and, since at least the 1990s, the ecosystems that are the context for health and wellbeing of all animals and humans (ecosystem health). None of these changes in veterinary work was accomplished without some turmoil, as they have affected the nature of veterinary practice and the perception of the profession by the public.

From its inception, a sense of urgency and conflict has accompanied the field of ecosystem health; veterinarians have been caught up in debates over such issues as genetically modified organisms, the emergence of such diseases as bovine spongiform encephalopathy (BSE), avian influenza, severe acute respiratory syndrome (SARS), the increasing frequency and destructiveness of extreme weather events, and the loss of wild species that are important both ecologically and as food sources (the collapse of ocean fisheries, for example). Overlaying all of these are global changes in climate and environment, which are occurring much more quickly than the models predicted. Every one of these issues can be defined in terms of economic, social, ecological, and health concerns; most of them present themselves as crises to which we must respond, as well as opportunities to promote long-term preventive measures.

For most of these issues, veterinarians are caught in the middle of a variety of conflicting pressures, having clients and patients from public health, wildlife, livestock, and companion animal sectors. Veterinarians in Canada are internationally known for being at the forefront of finding solutions.

While the concerns have expanded, the methods to address those concerns have not always kept pace. What does it mean to practice ecosystem health? Since the late 1980s, scholars and practitioners in the fields of health, ecology, and community development have struggled with these seemingly intractable issues for which appropriate policy and management interventions are not obvious, and for which conventional investigative methods seem particularly weak (1–4). Globally, one can frame these issues in terms of the Millennium Ecosystem Assessment (<http://www.millenniumassessment.org/en/index.aspx>) and the reports of the Intergovernmental Panel on Climate Change (<http://www.ipcc.ch/>), which represent the most comprehensive and thorough scientific assessments of the planet in history, and the Millennium Development Goals (<http://www.un.org/millenniumgoals/>), which represent the agreed-upon aspirations of the international community of nations.

These issues are, as philosophers Ravetz and Funtowicz (5,6) have argued in their work on uncertainty and risk assessment,

characterized by uncertainty about the facts, conflicts over values and legitimate knowledge, high stakes, and an urgent need for decisions.

These kinds of issues cannot be contained within any disciplinary or institutional boundaries. One solution, embedded in the way many of our institutions are structured (invoking disciplinary boundaries between and within medicine, health, agriculture, environment, economics) has been for each discipline to do its own excellent work, and then expect decision-makers in government and business to synthesize competing claims into coherent, long-term solutions. However, over the past several decades, several international networks of scholars have worked at developing both the theory and the practice of how to respond more systemically and effectively to these issues. These have variously been termed conservation medicine (7), one medicine (8), one health (9,10), ecological integrity (11), sustainable livelihoods (12), resilience and its related theoretical base in panarchy theory (13), ecosystem health or agroecosystem health (14–17) and ecosystem approaches to health, usually shortened to “ecohealth” (18,19).

Each of these schools of thought and action has different strengths: the integrity group, for instance, has tended to focus on legal and policy issues; the resilience and panarchy group have focused on research into how and why different social-ecological systems develop over time, while others crash; one medicine considers links between veterinary medicine and human medicine, and one health broadens this to look at health issues (not just disease) that cross species boundaries and often involve environmental changes; conservation medicine is a marriage of conservation biology and wildlife and zoonotic disease ecology. All attempt to address the complexity of issues at the health-environment-society interface.

Among the different fields of activity and inquiry, ecohealth is the one which has most worked on process, as well as outcome: we wish not just to study, but to make decisions, take action, and evaluate outcomes. While the other schools of thought define fields of inquiry, ecohealth defines an area of practice. The outcomes that concern us are sustainable human and animal health and wellbeing, through healthier ecosystems. The questions then become, in such a complex set of interactions, how does one make decisions? Who makes them? Where there are conflicts, for instance between sustainability of wildlife habitat, aquatic health, public health, livestock, pets, and economic development, do we privilege some concerns over others?

An ecosystem is a “system description of the interacting biota and environment of some place over some time period.” Following from this, ecosystem approaches in general see

“humans as living in the biosphere as a home rather than the planet being the house of man.” (20). Hence some of the literature uses terms such as ecosocial systems and social-ecological systems. Health is one outcome of the interactions that occur within ecosystems at various scales; either or both human and animal health are considered outcomes. The much more controversial study of the “health” of ecosystems is what is classically referred to as ecosystem health. Many of us who started working on ecosystem health shifted our emphasis to ecohealth because it became apparent that conflicts over trade-offs, and how one achieved outcomes, were as important, in the long run, as achieving the outcomes themselves. It is possible, for instance, to “solve” the problems of avian influenza or childhood diseases in such a way that the immediate problem is solved, but the solution is either not sustainable, or the long-term collateral damage to communities and ecosystems may be worse than the original presenting complaint.

Ecohealth can be defined as systemic, participatory approaches to understanding and promoting health and wellbeing in the context of social and ecological interactions. They reflect not only an understanding of social systems and ecosystems, and how they interact, but also a convergence of applied, organizational ideas from business management, environmental planning, community operations research, participatory action research, critical systems theories and a variety of other fields (21–23). They are based on theories of complexity and complex systems in much the same way that clinical judgment is based on understanding of physiology and the workings of the body’s various systems. In other words, to fully understand the reasons behind ecohealth approaches, one should delve into complexity theories, but understanding these in depth is not necessary to exhibit good clinical decision-making. Ecohealth also differs from paradigmatic scholarly approaches such as epidemiology, experimental science and sociology in that they transcend and integrate these to understand and manage real-world situations. There is no over-arching paradigm for these approaches, and hence they fall into the field of Funtowicz’s and Ravetz’s post-normal science. One manifestation of these approaches, the Adaptive Methodology for Ecosystem Sustainability and Health (AMESH), grew out of collaborative investigations led by veterinarians in Latin America, Canada, East Africa, and Asia (14,19,24).

The primary journal in the field is called, not surprisingly, *EcoHealth*, and is the official journal of the International Association for Ecology and Health; Ecohealth is also the name of a major Program Initiative of the International Development Research Centre.

There is no single set of techniques that defines ecohealth. Nevertheless, all are characterized by transdisciplinarity, methodological pluralism, public engagement, systemic thinking that links ecological and social phenomena, and embody a socially equitable process of learning, monitoring, and learning again. This is a major differentiation from, say disease ecology or environmental epidemiology, which are often best done by multidisciplinary teams of experts. AMESH, for instance, provides a general schematic for the areas that need to be addressed in doing this kind of work, and the guiding questions that

clinicians (a disciplinary and occupationally diverse group of investigators) need to be asking.

This reflects the fact that in many respects ecohealth is closer to the process a good clinician uses, rather than classical science; ecohealth practitioners integrate a history of how the current situation came to be, with clinical examination, epidemiological probabilities and laboratory test results, to arrive at a reasonable diagnostic conclusion and course of action. Unlike professionals working with individuals or small groups (herds, flocks, farms, neighbourhoods), ecohealth practitioners must grapple issues of defining the boundaries of the “patient” (farm? watershed? region? globe?), and multiple interacting problems and solutions, for which there are multiple claims of ownership. Hence the nature of the complaint, the relevant facts in a case, the systemic connections, and the most desirable outcomes are all in dispute. The waterborne outbreak of *E. coli* 0157:H7 in Walkerton, Ontario in 2000, for instance, involved such variables as individual behavior, farm management, city politics, provincial policies, regional weather, and climate change (1).

For the ecohealth practitioner, as for any applied practitioner, the difficulties of making decisions based on incomplete evidence are challenges rather than road blocks. Ecohealth has had its greatest demonstrated successes when applied to local geographically bounded communities, where stakeholders, problems, and boundaries can be negotiated in face-to-face meetings (19). However, networks of investigators and practitioners are working on more complex problems, where multi-level farm to globe feedback loops and stakeholders need to be accounted for.

Much of the work is being done through networks of people from a wide variety of disciplinary and institutional backgrounds. Communities of Practice for Ecosystem Approaches to Health (CoPEHs) have been created, for instance, in Latin America and the Caribbean; South and Southeast Asia; Middle East and North Africa; West and Central Africa; and Canada. It is worth noting that a Canadian institution, the International Development Research Centre (IDRC), has been the primary support and impetus for these CoPEHs worldwide.

These CoPEHs cover a broad range of concerns and outcomes, from emerging diseases to toxins in the environment to water management. The CoPEH — South and Southeast Asia, which focuses on emerging infectious diseases, was started and is being maintained by Veterinarians without Borders/Vétérinaires sans Frontières — Canada, with technical assistance from Google.org, and financial aid from the Canadian Food Inspection Agency (CFIA), the IDRC, and private donors. Members include individuals and groups from governmental, nongovernmental, and trans-national organizations, as well as universities.

CoPEH-Canada, funded by the IDRC, and linking social scientists, biologists, veterinarians, physicians and philosophers from University of British Columbia, University of Guelph, and Université du Québec à Montréal, is working on developing teaching and research programs

Community health and herd health were important developments in how health in populations of people and animals have been investigated and promoted in the 20th century. Similarly,

ecohealth is rapidly becoming the way in which the larger challenges of global health and sustainability can be faced.

Why, one might ask, would veterinarians be drawn into these kinds of complex issues? There is a variety of reasons for this. In many cases, such as those involving food safety and emerging zoonoses, veterinarians are uniquely qualified to think across a wide range of species, from wildlife to pet dogs, from marine mammals and wild birds to cattle and horses. More generally, veterinary work inherently involves thinking and synthesizing information from many sources (economics, zoology, ecology, medicine) and from many spatial scales (microbial attachment mechanisms, animal behavior, agri-food systems structures). Furthermore, veterinarians (as a profession, and sometimes even as individuals) can talk as easily with a farmer in a barn as with a government official, and shift topics from a calf with diarrhea or a dead seagull to the implications of international policies on disease emergence. The ability to facilitate the exchange of information and debate across social, economic, and disciplinary boundaries is not something we should take for granted.

Veterinarians are not, nor should we be, the only players in this field. Indeed, we will only be effective participants to the extent that we can work with many people, with disparate knowledge and skills, to solve complex problems. It is a challenge, sometimes frustrating and tiring, but often exhilarating and rewarding. Our children will thank us if we take up that challenge.

References

1. Arya N, Howard J, Isaacs S, et al. Time for an ecosystem approach to public health? Lessons from two infectious disease outbreaks in Canada. *Glob Public Health* 2009;4:31–49.
2. McMichael AJ. Integrating nutrition with ecology: Balancing the health of humans and biosphere. *Public Health Nutr* 2005;8:706–715.
3. Parkes MW, Bienen L, Breilh J, et al. All hands on deck: Transdisciplinary approaches to emerging infectious disease. *EcoHealth* 2005;2:258–272.
4. Weiss R, McMichael AJ. 2004. Social and environmental risk factors in the emergence of new diseases. *Nat Med* 2004;10:S70–S76.
5. Funtowicz SO, Ravetz JR. *Uncertainty and Quality in Science for Policy*. Dordrecht: Kluwer; 1990.
6. Funtowicz SO, Ravetz R. Uncertainty, complexity and post-normal science. *Environ Toxicol Chem* 1994;13:1181–1185.
7. Aguirre AA, Ostfeld RS, Tabor GM, House C, Pearl MC. *Conservation Medicine: Ecological Health in Practice*. New York: Oxford Univ Pr, 2002.
8. Schwabe CW. *Veterinary Medicine and Human Health*. Baltimore/London: Williams & Wilkins, 1984.
9. Frank D. One world, one health, one medicine. *Can Vet J* 2008;49:1063–1065.
10. Kahn LH. Confronting zoonoses, linking human and veterinary medicine. *Emerg Infect Dis* 2006;12:556–561.
11. Pimentel D, Westra L, Noss RF, ed. *Ecological Integrity: Integrating Environment, Conservation, and Health*. Washington, DC: Island Pr, 2000.
12. Helmore K, Singh N. *Sustainable Livelihoods: Building on the Wealth of the Poor*. Bloomfield, Connecticut, USA: Kumarian Pr, 2001.
13. Gunderson LH, Holling CS, editors. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington: Island Pr, 2002.
14. Gitau T, Gitau M, Waltner-Toews D. *Integrated Assessment of Health and Sustainability of Agroecosystems*. Boca Raton: Taylor and Francis/CRC Pr, 2008.
15. Nielsen NO. Ecosystem health and veterinary medicine. *Can Vet J* 1992;33:23–26.
16. Ribble C, Hunter B, Lariviere N, et al. Ecosystem health as a clinical rotation for senior students in Canadian veterinary schools. *Can Vet J* 1997;38:485–490.
17. VanLeeuwen J, Waltner-Toews D, Abernathy A, Smit B. Evolving models of health toward an ecosystem approach. *Ecosystem Health* 1999;5:204–219.
18. Lebel J. *Health: An Ecosystem Approach*. International Development Research Centre, Ottawa, 2003.
19. Waltner-Toews D, Kay J, Lister N-M, ed. *The Ecosystem Approach: Complexity, Uncertainty, and Managing for Sustainability*. New York: Columbia Univ Pr; 2008.
20. Allen T, Bandurksi B, King A. *The Ecosystem Approach: Theory and Ecosystem Integrity*. Washington: Report of the Great Lakes Advisory Board, International Joint Commission; 1991.
21. Bunch M, McCarthy D, Waltner-Toews D. A family of origin for an ecosystem approach to managing for sustainability. In: Waltner-Toews D, Kay J, Lister N-M, eds. *The Ecosystem Approach: Complexity, Uncertainty, and Managing for Sustainability*. New York: Columbia Univ Pr, 2008:125–138.
22. Checkland P, Scholes P. *Soft Systems Methodology in Action*. Chichester: John Wiley & Sons, 1990.
23. Parkes M, Panelli R. Integrating catchment ecosystems and community health: The value of participatory action research. *Ecosystem Health* 2001;7:85–106.
24. Waltner-Toews D, Kay J, Murray T, Neudoerffer C. *Adaptive Methodology for Ecosystem Sustainability and Health (AMESH): An Introduction*. In: Midgley G, Ochoa-Arias AE, eds. *Community Operational Research: Systems Thinking for Community Development*. New York: Plenum Publications/Kluwer Academic, 2004.